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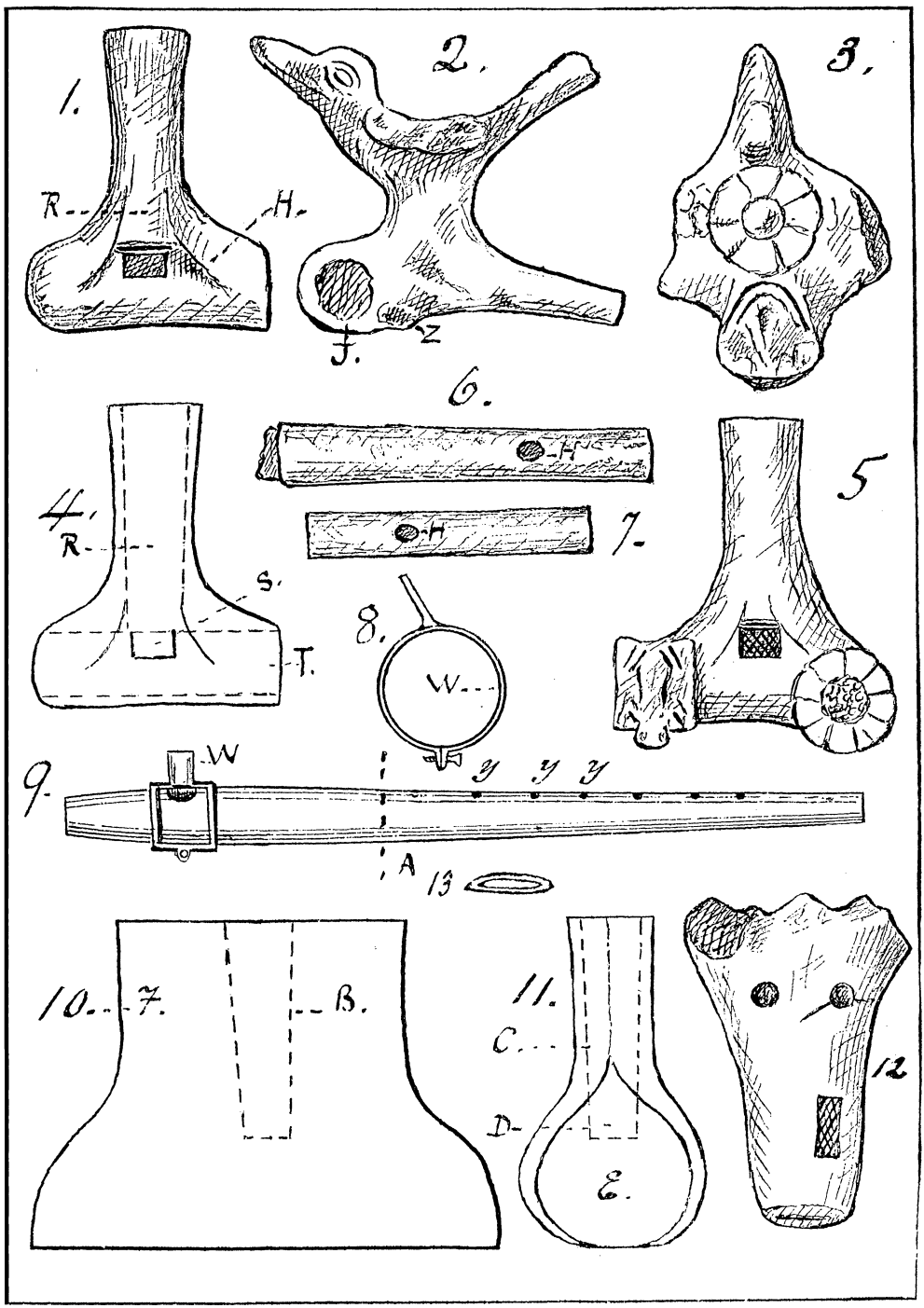
CONSTRUCTION OF ANCIENT MEXICAN TERRA-COTTA PITCH-PIPES AND FLAGEOLETS.

BY H. T. CRESSON.

THE smooth internal structure of the pitch-pipes[1] and flageolets of baked clay, or terra-cotta, manufactured by the ancient Mexican potters, suggest that they have been modeled upon forms of some material capable of receiving a high degree of polish, probably bone or wood. The pitch-pipes shown in Figs. 2–5 (Plate XVI) have been made in this way, and are the most ingenious specimens of aboriginal plastic art in the collection of musical and other Mexican antiquities made by the Honorable J. R. Poinsett, United States Minister to Mexico in 1830. Figs. 1 and 2 (Plate XVI) are the front and profile views of a pitch-pipe, which is more primitive in style of construction than those shown in Figs. 1, 3, 5, 6 (Plate XVII), hereinafter described. An analysis of its construction shows that it has been made in three parts, viz., a clay reed, Figs. 1, R, 4, R (Plate XVI), a neck-piece or flap, Fig. 10 (Plate XVI), and a body, Fig. 4, T. A careful piece of workmanship is shown in the modeling of the first-named portion, or clay reed, Fig. 4, R, by means of which the air from the lungs of the performer is conveyed into the sound hole, Fig. 4, S, thus communicating with the body of the instrument, Fig. 4, T. This part measures one and three-quarter inches in length, by half an inch in width at its broadest portion (mouth-piece), gradually contracting as it approaches the sound-hole, Fig. 4, S, to about six-sixteenths of an inch. These measurements have been made from thirteen different clay reeds, and in the average, vary but little from one another. A section made through a neck-piece, parallel to the opening of the air passage, shows that the form upon which the clay reeds, Figs. 1, R, 4, R (Plate XVI) were modeled, had the shape of a thin, elongated wedge, an outline of which is given by the dotted lines in Fig. 4, R. The flaps, Fig. 10, F, were then cut out of clay rolled thin,

[1] As the instruments which are denominated pitch-pipes have heretofore generally been called whistles, it will be necessary to state that since the discovery of their musical powers (most of the retort-shaped pipes in the Poinsett collection possess stop-holes which, when closed, change the pitch of their respective instruments), it will be impossible to class them as such. The name pitch-pipe has, therefore, been adopted. See "Musical Instruments in the South Kensington Museum," by Carl Engel, page 285. (1385–'64.)



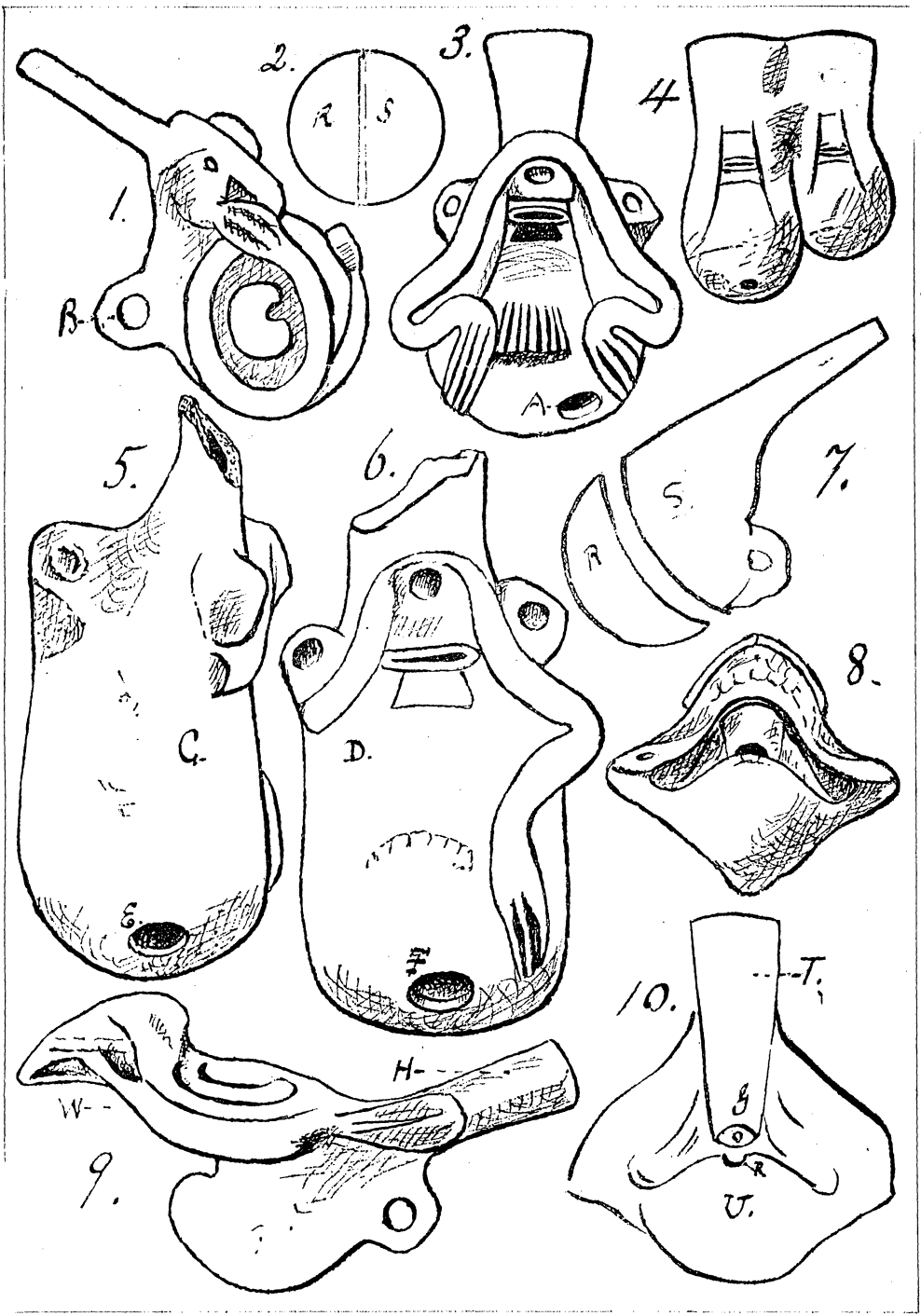
Ancient Mexican Musical Instruments.

similar in shape to the outline shown in Fig. 10, and the clay reed, Fig. 10 B, enveloped therein. The dotted lines in Fig. 11 C, represent the clay reed, Figs. 1 and 4 R (Plate XVI), after the flap Fig. 10 F, has been modeled around it. This, it will be seen, divides into two portions a little distance above the narrow end of the reed, Fig. 11 D, which overlies the sound-hole upon the body portion, Fig. 4 S, running to either side and protruding beyond its terminal portion about two and a-half inches. This forms the notch into which the body of the pitch-pipe is introduced, Fig. 11 E (Plate XVI). A view of a section of the clay reed, made parallel to its aperture, Fig. 13 (Plate XVI), shows the exact size and shape of the air-passage. Specimens of these instruments, which have been detached in sections, suggest that this covering of the clay reed by the flap, Figs. 10, F and 11, C,[1] was accomplished while the reed was in a semi-dry condition. In order to understand the method pursued in joining earthenwares that have been made in pieces, it will be necessary to consider briefly the processes of our modern potters. Fictile wares, modeled upon the wheel or lathe, at a certain stage of the drying process possess a greater tenacity than at any other time, until they are baked—this is called by potters the green, or semi-dry state. While in this condition they are attached to the lathe by a little moisture, and turned nicely into the proper shape. This same degree of dryness, which admits of the clay being turned on the lathe, serves for attaching the handles or other appendages to earthen vessels. The parts to be attached, having been prepared, are joined together by means of liquid clay (called slip, by the potters), and the seams having been smoothed off and finished by careful modeling, are then ready for the kiln, which is to convert the tender clay into the hard biscuit. Having thus explained the way of making jointures while the clay is in semi-dry condition, it may be inferred, as the process of the ancient Mexicans did not in all probability differ essentially from those used by our modern potters, either in material or other methods of manufacture, excepting of course the use of the lathe, that these old potters used the semi-dry state to cover the clay reed with the clay flap, in order to avoid compressing the air-passage (which is very narrow, see Fig. 13, Plate XVI, where exact size thereof is given), at the

[1] The dotted lines in Fig. 11 C (Plate XVI) show the outline of the clay reed when covered with the protruding end thereof, Fig. 10 D (Plate XVI).

same time, allowing the form to be withdrawn before the clay reed had become hard and brittle. A section of the body portion of a pitch-pipe, like Fig. 4, R, T (Plate XVI), shows the shape of its interior, indicating the use of a cylindrical form, about two inches in length, upon which this portion, one and three-eighth inches long, was modeled. One end of the barrel is closed by a stopper of clay, the other remaining open.[1] The careful finish noticeable in the interior of all these musical instruments, forms a striking contrast (especially in the more primitive specimens, Figs. 1, 2, 5), when compared with the rough modeling of their exterior portions; this would be absolutely necessary, as any imperfection therein would interfere with the accuracy and quality of the tones emitted. A decided advance in the construction of primitive musical instruments was made by the ancient Mexicans beyond the simple tube or whistle, when their artisans produced such forms as Nos. 1, 2, 5 (Plate XVI). Take, for example, some of the primitive forms of whistles without finger holes, exhibited in the collections of the Smithsonian and Peabody museums, Figs. 6 and 7 (Plate XVI), which have already been described by Dr. C. C. Abbott in the United States Geographical Surveys west of the 100th meridian, p. 235 (illustrations Nos. 115, 116, 119 of that work). These, when applied to the lips and a current of air was impelled therein from the lungs of the performer, were no doubt (while in a perfect condition) capable of producing certain shrill notes. Blowing through a very small aperture of the lips against the edge or orifice of the sound-hole, thus directing the wind chiefly within the tube, naturally requires more practice in order to produce different notes. An invention was devised by the ancient Mexicans to overcome this difficulty of labial manipulation, by means of which the sounds were made even and regular, and were easily produced. The modern fife is sometimes furnished with a mouth-piece similar to that shown in Figs. 8–9, W (Plate XVI), which directs the current of air from the lungs of the performer, thus requiring less skill and labor to produce the requisite volume of sound. It will be seen that this mouth-piece, Fig. 9, W (Plate XVI), used upon the fife, is similar to that portion of the pitch-pipe which has been denominated the neck-piece, and is

[1] When the pitch-pipe is blown into, by stopping the aperture of the barrel with the finger, a note one-fourth lower than that given while open, is produced. (See Proceedings of the Academy of Natural Sciences of Philadelphia for 1883, p. 86. Aztec Music.)



Ancient Mexican Musical Instruments.

attached to the body portion of the terra-cotta pipe, shown in Fig. 4, T, by means of the notch formed by the clay flap in enveloping the clay reed, Fig. 11, E[1] (Plate XVI). A good illustration of this can be made by attaching a metal mouth-piece to one of our modern fifes, Fig. 9 (Plate XVI), and then sawing it asunder between the sound-hole, Fig. 9, W, and the finger perforations, Fig. 9, Y, Y (shown by the dotted lines). This having been done the result would be an instrument similar to Figs. 1 and 4 (Plate XVI).[2]

A pitch-pipe, showing an advance in construction upon that already described, resembling somewhat a retort in form, is shown in Figs. 1–3 (Plate XVII). It is modeled in four pieces, and the clay reed has been made in the same manner as those upon the sections shown in Figs. 10 and 11 (Plate XVI), differing only in the form of the body, which is circular. In order to accomplish the modeling of the body portion, it would be necessary to use a circular form, dividing it into two portions, Fig. 2 (Plate XVII), one half being modeled on one portion, Figs. 2, R (Plate XVII), and the other half upon the other side, Figs. 2, S (Plate XVII). The two halves being made so as to correspond nicely when joined together. The double pitch-pipe, shown in Fig. 4 (Plate XVII) demonstrates that this method was pursued, from the fact that while in the kiln the two halves which compose the body have been separated by the action of the heat, thus showing its construction. By careful examination traces of this jointure can be seen in some of the pitch-pipes, although in most cases it is impossible to detect it, so nicely have the marks of jointure been concealed by skillful modelings. Each one of the retort-shaped instruments, Figs. 1–3 (Plate XVII) is pierced by a stop-hole,[3] Fig. 3, A (Plate XVII), which is placed to the left hand side of a line drawn longitudinally around the body of the pipe, passing through the center of the sound-hole (holding the neck-piece toward the

[1] The fact must not be overlooked that the clay reed is enveloped by the clay flap, these two parts constituting the neck-piece.

[2] The clay reed, Fig. 1, R (Plate XVI) attached to the body of the ancient Mexican pitch-pipes of terra-cotta, Figs. 1 and 2 (Plate XVI), by means of the clay flap, Fig. 10 F (Plate XVI), resembling the mouth-piece of our modern fife, shown in Fig. 9 W, is therefore an invention of our North American aborigines.

[3] When the stop-holes are left open in the right-angled and retort-shaped pipes, Fig. 1, R (Plate XVI) and 1–3 (Plate XVII); if the instruments are blown into, notes one-fourth above those given when closed are obtained in all the pipes excepting the No. 8 or octave pipe, which gives the interval of a fifth.

performer. Underneath the retort-shaped pitch-pipes, close to where the neck-flap and body are joined together, Fig. 1, B (Plate XVII), there is generally a button of clay, pierced by a hole through which a cord might be passed, forming a loop for suspension, or to attach it to the body of the musician. The primitive pipes shown in Figs. 1 and 5 (Plate XVI) do not have the button attached, but are pierced by a hole, used for a like purpose, made through the thick part of the neck-piece, Fig. 2, Z (Plate XVI), near to its jointure with the body.

A large pitch-pipe, Figs. 5–6 (Plate XVII), the character and outline of which are admirably shown by the artist, has been found among the specimens of the Poinsett collection since the publication of an article upon Aztec music by the Academy of Natural Sciences of Philadelphia. The instrument in question, Figs. 5–6, is pitched in the scale of A (three sharps compared with the flute), and the construction of the neck-piece and other parts differs but slightly from those already described. The body portion, Fig. 5, C and 6, D (Plate XVII), is considerably elongated and well adapted to produce the rich, mellow sound which it emits when blown into. Traces of jointure in this specimen are admirably concealed, and demonstrate that the body of the instrument was made in two pieces (upon a form) similar to that shown in Fig. 7, R, S (Plate XVII), although much more elongated. The body is pierced by a stop-hole, Figs. 5, E and 6, F (Plate XVII), like other pipes, and may be classed, on account of its construction and the grotesque decoration of its exterior, with those of retort-like form, shown in Figs. 1–3 (Plate XVII).

The construction of the Aztec pitch-pipes in the Poinsett collection of antiquities having been described, it will be necessary to say a few words upon their progression from primitive instruments, which it may, in all reason, be assumed were produced as among other barbarian nations, while their ancestors were in a savage state. As shells pierced by sound holes, and hollow tubes of bone or cane (without finger holes) were in all probability the most primitive instruments manufactured and used by the ancestors of the Aztecs, it may readily be granted that these, however rude when first invented, gradually improved as they advanced toward the middle status of barbarism. The primitive whistles already mentioned, Figs. 6, H, 7, H (Plate XVI), which were exhumed from the graves of the savage tribes who inhab

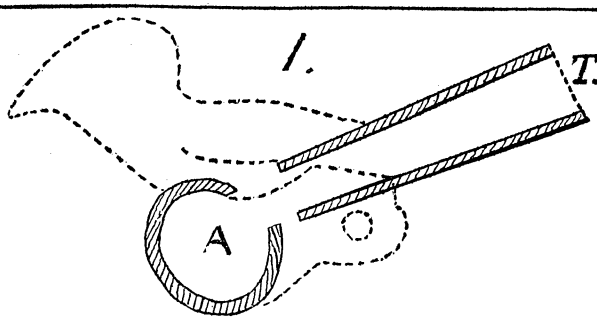
ited the coast of California, may be taken as examples of progression and improvement upon the simple tube and whistle of bone or cane, from the fact that they possess sound-holes, Fig. 6, H, 7, H (Plate XVI) cut for labial manipulation. The clay reed or neck-piece, Figs. 4, R, 11, C (Plate XVI), which resembles the neck-piece of our modern fife, Fig. 9, W (Plate XVI), was probably thus invented, and when attached to the primitive whistles (like those, for instance, found in the graves of the California coast), increased the volume and regularity of sound, forming the simple mouth-piece whistle without a stop-hole. This afterwards became the right-angled Aztec pipe, shown in Fig. 1 (Plate XVI), an end of which was left unclosed (see profile view of pitch-pipe, Fig. 2, J (Plate XVI), a strong proof that its inventor sought diversity of sound. The artisan who designed these ancient Mexican instruments evidently sought to improve their qualities of sound, which at first were shrill and cacophonous. To overcome this defect, the body of the right-angled pipe, Fig. 1 (Plate XVI), was expanded into a globular shape, placed parallel to and in front of the clay reed, and then pierced by a stop-hole, thus producing the pipe, Fig. 3, A (Plate XVII). This stop-hole, which first appears in the right-angled pipe, Fig. 2, J (Plate XVI) as before shown, is a most important step in the development of musical sounds among the Nahuatalacs, as it can be manipulated by closing and opening the same, thus depressing or raising the pitch of the instrument. These stop-holes, doubtless, suggested to the terra cotta instrument-makers of later date their gradual adoption as finger-holes. It is interesting here to remark the increase in volume and sweetness of sound that had been obtained by the ingenious Nahuatalac clay-worker or musical artisan, by elongating the body of the retort-like pipe, shown in Figs. 1 and 3 (Plate XVII), although it produced a somewhat unwieldy, still not ungraceful, instrument, Figs. 5–6 (Plate XVII), which is narrowest at the end of the body nearest the stop-hole, Fig. 5, E (Plate XVII).

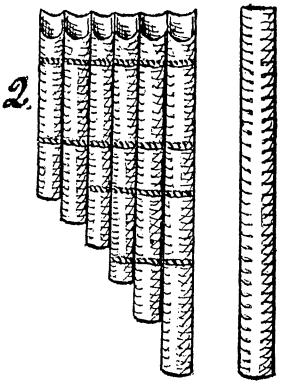
A specimen not unlike this last-named instrument was found upon the Island of Ometepec, in the Great Lake of Nicaragua, by the late Dr. Carl Hermann Berendt; a drawing of it is given by Mr. Barber in his valuable article upon "Indian Music, published in the AMERICAN NATURALIST of March, 1883. The elongated pitch-pipes, Figs. 5–6 (Plate XVII), are perhaps an intermediate form of pipe, between the retort-shaped instruments, Figs.

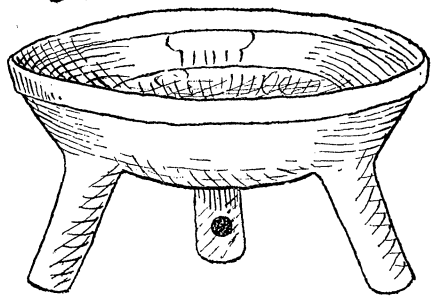
1–3 (Plate XVII), and the four-holed Tezcucan flageolets,[1] whose musical instruments probably attained the highest degree of perfection known to the Nahuatalacs.

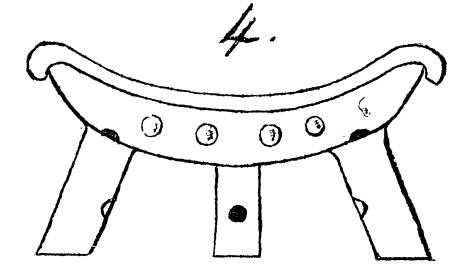
Karl Engel, in his "History of the most ancient Musical Instruments," demonstrates that among ancient nations of the Eastern continent, wind instruments were gradually improved in construction and power of sound. He mentions a pipe found by Captain Willock in the ruins of Babylon (Bis-Nimroud), as follows: "It resembles somewhat the flageolets and whistles of clay found in Mexico and Central America." The pipe in question, Fig. 12 (Plate XVII), copied from Engel's work, "is about three inches in length, and has only two finger-holes, placed side by side, and consequently equidistant from the end at which it is blown. The opposite end has no opening, the instrument, in this respect, resembling a whistle. If both finger-holes are closed it produces the note C; if only one of them is closed it produces E; and if both are open it produces G. Besides these notes one or two others are obtained by some little contrivance; thus by blowing with unusual force the interval of a fifth G may be raised to that of a sixth A, but the fixed and natural notes of the instrument are only the tonic, third and fifth. It is remarkable that the third, which is obtained by closing the left finger-hole, is about a quarter tone lower than the third which is obtained by closing the right finger-hole. Perhaps it was intended for the minor third. This is, as far as I am aware, the oldest musical instrument hitherto discovered which has preserved its original condition, yet it is constituted of so fragile a material that were it to fall from the hand to the ground, it would most likely be destroyed forever. But its notes cannot have been clearer two thousand years ago than they are at the present day. The shape of the instrument appears to be intended to represent the head of an animal. This interesting relic, described by Engel, is not unlike the Aztec pitch-pipes, and like the Mexican pipe shows how the simple

[1] The four-holed flageolet of terra-cotta, shown in the plate, was found near the city of Tezcuco, and is probably of Aclolhuan origin, a people whom we are led to suppose were much more advanced in the arts than their blood relations, the Aztecs. An examination of the external contour of this instrument in the plate, Fig. 4 (Plate XIX), will show that the barrel or body of the flageolet is much narrower and more elongated than that of the pitch-pipe, Figs. 5–6, (Plate XVII). The interior construction shows an increased expansion underneath the sound-hole, Fig. 5 K (Plate XIX), and marked contraction at the bell end, Fig. 7 F (Plate XIX).









Ă.B̂. C̆̆.D̂.

Fig 5. 3. 5. 7. 7. 9. 11 or 3. 7. 5. 5. 7. 9. 11.

Fig 6. 1. 3. 8. 8 . . . . or 1. 3. 8. 8 (E. flat)

Fig 7. 2. 4. 6. 9 . . . or Scale of F (Natural)

Fig 8. 3. 5. 7. 7 . . . or Scale of D (2 sharps)

Fig 9. 4. 7. 8. L. Double whistle*, Scale of A♭ (4 flats)

Also other interesting Combinations, Viz. . . .

2. 2. 6. 9. or F (1 flat) . . . 3. 2. 5. 7. D (5 flats)

6. 5. 7. (Octave-missing) G (1 Sharp) or 6. 6. 8. L.W (G 1 Sharp)

* L Double Whistle, see fig 4 (Plate 2.)

whistle may be made to produce a variety of sounds by the addition of finger perforations. It also resembles them in its powers of producing different sounds, of a higher pitch, by blowing with unusual force."

As the manipulation of the ancient Mexican pitch-pipes of terra-cotta has never been fully described, some details upon the subject will be necessary. It has been mentioned in a former article that the clay pitch-pipes which stand in the scale of E flat, may be played singly or in quartette. The single manipulation was accomplished by the well-known soloist on the Baehm flute, Professor J. S. Coxe (who having arranged the pitch-pipes in a cardboard frame like a mouth organ), was enabled to play thereon numerous simple melodies. By this means results were obtained (by one performer) like those produced by four persons manipulating them alternately (holding one in each hand). A record has been kept of these manipulations by numbering the whistles from tonic to octave (1–8), and as a ninth, eleventh and twelfth exist (alto a double whistle) the numeration was extended to twelve. As it is necessary, in producing certain intervals and melodies, to close the stop-holes upon some instruments, leaving them open in others, the black dot placed alongside of the numbers or letters indicate closed stop-hole, and the naught open stop-hole. The different signs or modulations for the blowings, shown in Figs. A B C D (Plate XVIII) signify blow evenly (Fig. A sign thus ⌣ turned upward) and blow hard, (Fig. B ⌢ turned downwards).

Where it is necessary to blow very hard, double modulation signs are used (turned upward). In blowing soft, and vice versa, in blowing very hard (turned downward). By this means a method of procedure is obtained by which all confusion can be avoided, and the pipes played with facility. If the note of the large elongated pitch-pipe, Fig. 6 (Plate XVII), standing in A (three sharps), be taken as a tonic note, the intervals of two octaves[1] may be obtained by following the enumerations and stoppings given in Fig. 5 (Plate XVIII). The scale of E flat is given in Fig. 6 (Plate XVIII), also several other combinations of intervals in other scales, such as F

[1] A second method of fingering and stopping is given in Fig. 5 (Plate XVIII), by means of which the intervals of two octaves may be obtained. This fingering, however, owing to some imperfection in one of the pipes, does not produce the intervals clearly. Some of the whistles have been impaired by their long burial.

natural, Fig. 7 (Plate XVIII), D (two sharps), Fig. 8 (Plate XVIII), and finally the intervals of the scale of A (four flats), Fig. 9 (Plate XVIII).

That duplicates of these Aztec pipes of terra-cotta exist (in the Poinsett collection of Mexican antiquities) which are pitched in like keys, has been proven beyond a doubt, viz., three duplicates of the octave or No. 8 pipe (scale of E flat), two of No. 9, two of No. 5 pipes. It is certainly an interesting fact that in a collection of sixteen pitch-pipes, seven out of this number correspond with one another. *This sameness of pitch cannot therefore be attributed to an accidental similarity of musical sounds.*

Terra-cotta pitch-pipes, similar to those shown in Figs. 1 and 5 (Plate XVI), which were excavated in 1852 from an ancient tomb near Vera Cruz, by the late Professor Charles H. Budd, are pitched in like tones to Nos. 8 and 9 in the Poinsett collection.

The Indians of the present day, in various parts of Mexico, manufacture whistles of an inferior kind, which do not, however, in any way approach the ingenious clay-reed pipes of their ancestors, either in construction, tone or decoration, still there is an innate love for music among the descendants of the old Nahuatalac and Maya races, which has frequently been commented upon by travelers. Dr. Habel's learned article entitled "Archæological investigations in Central and South America," published by the Smithsonian Institution in their Contributions to Knowledge, page 45, speaking of the South American Indians, states that he found the pipe the only national instrument. It is of various dimensions, and almost every traveling Indian has one at hand, piping while he walks on the road or in the market.

Whistles fashioned like birds, animals and monsters of grotesque shape are quite numerous in the cemeteries of Mexico and Central America. They generally emit shrill sounds, which Mr. Barber, in his valuable article on "Indian Music," has compared to a peculiar noise like the escape of steam (AMERICAN NATURALIST of March, 1883). Others examined by the writer of this article give harsh sounds when blown into forcibly, not unlike the chatterings of macaws and parrots. They had been modeled in three pieces, viz., the mouth-tube, Fig. 10 T (Plate XVII) and Fig. 1 T (Plate XVIII). The body, which is most ingenious in construction, and bears an important part in the production of the sound emitted, is made in two parts

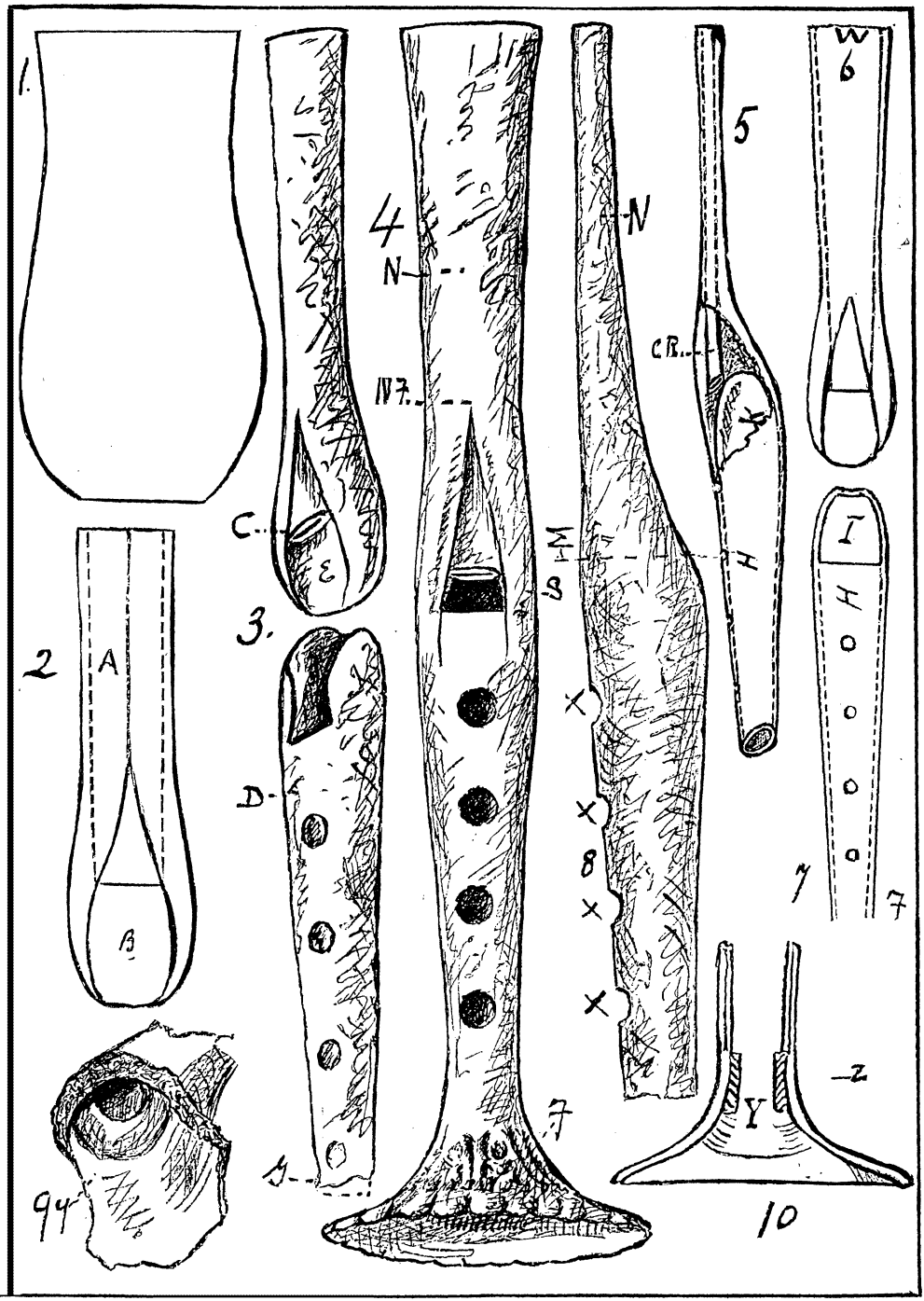
or pieces, viz., the body and cover, Fig. 10 U (Plate XVII) and Fig. 1 A (Plate XVIII). The grotesque whistle, Fig. 8 (Plate XVII), shows the jointure of its several parts, and for this reason it has been chosen for description. The mouth-tube, Figs. 10 T, 9 H (Plate XVII), is of simple construction, having been made upon a round form, narrowest at the end approaching the body portion, see Fig. 10 G (Plate XVII). This illustration has been drawn from an instrument in which the body cover, or top, has been removed. It will be seen that the mouth-tube is held in position by the clay flaps, on either side, opposite a small hole in the body of the whistle, thus directing the current of air into its hollow interior. The body was, without doubt, modeled upon a semi-ovate form, the perforated top being added after it was withdrawn. The position of the body varies in different whistles, but in most cases is tilted, with the flat top-piece (or cover of the semi-ovate body) forward and inward, thus placing the sound-hole exactly in front of the narrow end of the tubular mouth-piece, Fig. 10 G (Plate XVII), conducting the air within, and making the necessary vibration to produce sound. The body cover serves two purposes, that of uniting the body and mouth-tube firmly together, also that of reflecting sound outward, after its production in the semi-ovate cavity.

The four-holed Nahuatalac flageolet of terra-cotta, found near Tezcuco, Fig. 4 (Plate XIX), shows a superior knowledge in its construction, power and variety of sound to any other wind instrument of music manufactured by the North American aborigines excepting, of course, those manufactured by the Inca Peruvians. An examination of the various parts of the four-holed Tezcucan flageolets of terra-cotta will demonstrate that they have been made in four parts. viz., the clay reed, Fig. 2 A (Plate XIX), shown by the dotted lines; neck-covering, or flap, Fig. 1 (Plate XIX); the body, Fig. 3 D, and the bell, or foot, Fig. 4 F (Plate XIX). Sections of these instruments, Figs. 5, 6, 7 (Plate XIX), made in profile, indicate that they were modeled upon round elongated forms. That of the body portion is narrowest at the bell end, Fig. 7 F and 5 K. The shape of the form upon which the neck-piece was modeled, is shown by the dotted lines in Fig. 6, contracting at the sound-hole, and gradually expanding as it approaches the mouth end, Fig. 6 U. The finger-holes (four in number) have been perforated through the body Fig. 8, from the

outside while the clay was in a semi-dry condition. A hollow instrument seems to have been used for this purpose, leaving here and there small ragged edges of clay adhering to the interior of the barrel around the edge of the circular perforations. The bell, Fig. 4 F, is concave exteriorly, of circular form, and decorated with designs of unique patterns which have been stamped thereon by terra-cotta forms or dies. The internal portion of this bell is hollow, becoming convex as it approaches the edges, and contracting at the point of connection with the tube or barrel to a thickness of half an inch. Around this is formed a small cup-like cavity, Figs. 9 y, 10 y, which bears a most important part in manipulating the instrument. It can readily be seen, by an examination of the careful drawings shown in Figs. 9 y, 10 Y (Plate XIX), that these are not accidental formations, as has been suggested, but have been adapted to the form of the finger ends *to serve a particular purpose, viz., that of finger-stopping the bell.* The necks, Figs. 8 N, 4 N (Plate XIX), and clay reeds, Figs. 4 C, 2 A, 5 C R (Plate XIX), of these four-holed flageolets, have been modeled in the same manner as those upon the pitch-pipes, excepting that forms of greater length were required on account of the elongation of the mouth-piece.

The instrument shown in Fig. 4 (Plate XIX), viewed in front, is quite broad at the commencement of the mouth-piece, Fig. 4 (Plate XIX), contracting slightly as it approaches the division of the neck-flap, Fig. 4, N, F, and then expanding to its greatest thickness opposite the sound-hole, Fig. 4, S, where the neck-flap and body portion have been joined together (see section Fig. 5, Plate XIX). From the sound-hole it gradually contracts until the place of junction with the bell is reached, Fig. 3, G, from thence gradually increasing in size until near its lower portion (*i. e.* the bell proper), when the expansion and curvature is quite rapid, forming, at last, a flat plane upon its outer edge. Viewed in profile, Fig. 8, N, the neck is quite delicate, and like the reed in shape, Fig. 5, C, R (Plate XIX), gradually growing larger as the middle of the body, Fig. 8, M (Plate XIX) is reached. A gradual curve from above downwards here unites the mouth-piece with the body, which tapers gradually from this point until its junction with the bell, Fig. 4 F (Plate XIX), thus forming an instrument of graceful contour and artistic construction.

The instruments in the Poinsett collection of antiquities differ



Ancient Mexican Musical Instruments.

somewhat in the color of the glazes by which they are covered. The flageolet shown in the illustration, Fig. 4 (which was found with several others at Tezcuco, in Mexico), is covered with a light-red glaze. In the B flat instrument the glaze is a dark-brown color, and in other fragments of pipes, of like kind and construction, it is a heavy, vitreous glaze of a dark vermilion color, resembling that which covers the tips of the mouth-piece in the pitch-pipes. This glaze, in most cases, when the instrument is of a light color, is covered by one or two bands of a darker hue, generally placed as ornamentations between the first and second finger-holes, thus adding to the variety of the color, which would otherwise be monotonous. It is worthy of remark that ornamental bands of paint *overlie* the original glaze in some cases, and in others, as in the B flat instrument, they *underlie and are covered by it.*

Having considered the construction of the ancient Mexican pitch-pipes and four-holed flageolets of terra-cotta in all their parts, externally and internally, the student of aboriginal American plastic art cannot fail to be impressed with the ingenious construction, artistic feeling and inventive power displayed by the barbarian people who fashioned them. *This, it has been shown, was accomplished by modeling their terra-cottas upon forms* (in pieces), probably made of polished bone or wood. The pieces or sections produced upon the forms in question, were joined together while in a semi-dry or green state, by means of liquid or soft clay (which method is still used by our modern potters), thus enabling the ancient Mexican clay-workers to finish their musical instruments in parts. *The use of piece-forms* seems to have been quite common among the Nahuatalacs and the ancient clay-workers of Nicaragua,[1] Costa Rica and Peru in manufacturing

[1] The ancient pottery manufactured by those people who once occupied that portion of Central America now called Nicaragua, suggests, by its superiority of execution and glaze, that the potter's art here attained a higher degree of excellence than among the Aztecs, and in many respects, such as delicacy of form and finish, is equal to that of the Inca Peruvians. A good example of this is shown by a tripod vase, Figs. 3 and 4 (Plate XVIII), brought from Nicaragua by the late F. G. Smith, Esq., in 1859. It was found on the Island of Ometepec, in the Lake of Nicaragua, in a perfect condition, and during its transportation to the United States it was broken through the middle, thus revealing its interior construction. It will be seen by an examination of the careful drawing (showing a section thereof) that the body portion and legs were hollow and filled by small clay balls. It is the opinion of those skilled in the potter's art that this unique tripod vase could not have been made ex-

certain kinds and portions of their intricate terra-cotta fictile wares.

In conclusion, it is also worthy of remark that a knowledge of the process of modeling in clay upon forms seems to have been known to most all of the savage and barbarian nations of America who were acquainted with the art of pottery, and more especially to those of our American aborigines, who occupied the middle status of barbarism. Many of the beautiful earthenwares from the mounds of Louisiana, Missouri and those parts of our Western States at one time occupied by the mound-builders suggest the use of forms or shapes. Specimens of ancient water bottles from British Guiana and the (long-necked) bottle-shape jars and vases from the mounds of Indiana, Tennessee and Missouri in the William S. Vaux and Haldemann collections, prove the truth of these assertions.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— *E pur se muove.* The Philadelphia Academy has added two professors to its corps, and, it is said, will soon add a third. As the gentlemen selected are all capable, original investigators, important progress has thus been made. In fact, the organization adopted eight years ago may now be said to have the active support of the members of the academy.

The institution having at length acquired a center of vitality, new questions arise. Having escaped the Scylla of paralysis, it must avoid the Charybdis of being pressed into service which does

cept upon piece forms, and that the pieces modeled thereon were united during the semi-dry or green state. The clay balls in the interior of the legs and body portion are the best proof of this assertion, as they must have been placed therein during the jointure of the vase, before the firing process (see Fig. 4, Plate XVIII, where a section of this vase is given, showing the position of the clay balls between the plates of earthenware that form the body). It will be seen that these two concave disks are united together and so fashioned as to leave a space within, into which the pellets of clay were placed. There is no connection between the body part and legs except by delicate perforations about the size of a pin's head, leading from the body into the legs. The legs, in their turn, are perforated by small holes of a like kind, thus allowing the heated vapors to escape during the firing. The theory advanced by certain writers that the clay balls in the interiors of the Mexican Jacaxtli (and other hollow terra-cottas) were detached by a sharp cutting tool, after the firing, is an absurdity which no careful student of aboriginal American plastic art will credit.